

APRIL/MAY2025

**23PEMA43B — RESOURCE
MANAGEMENT TECHNIQUES
(Elective VI)**

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. What are three basic components of linear programming?
2. Define slack and surplus variable.
3. Tabulate the rules for constructing dual and primal.
4. List out the change that affect optimality.
5. What are the two general methods developed for generating special constraints in integer programming algorithm?
6. Explain the main idea of dynamic programming.



7. State the necessary condition for extreme points.
8. Write down the formula constrained gradient.
9. Define project.
10. What does forward and backward pass calculations determine?

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL the questions.

11. (a) Reddy Mikks produces both interior and exterior paints from two raw materials M1 and M2. The following data provides the basic data of the problem.

	Tons of raw material		
	Exterior paint	Interior paint	Maximum daily availability (tons)
Raw material M1	6	4	24
Raw material M2	1	2	6
Profit per ton	5	4	



Formulate as linear programming.

Or

2

4055



18. Solve the integer linear programming

$$\text{Max } z = 7x_1 + 10x_2$$

$$\text{Subject to } -x_1 + 3x_2 \leq 6$$

$$7x_1 + x_2 \leq 35$$

$$x_1 + x_2 \geq 0 \text{ and integer.}$$

19. Solve $\min f(x) = x_1^2 + x_2^2 + x_3^2$ subject to,

$$g_1(x) = 2x_1 + x_2 - 5 \leq 0, g_2(x) = x_1 + x_3 - 2 \leq 0,$$

$$g_3(x) = 1 - x \leq 0, g_4(x) = 2 - x_2 \leq 0, g_5(x) = -x_3 \leq 0.$$

20. For the following project determine the probabilities that the different nodes are realized without delay.

Activity Time estimates

1-2 (5, 6, 8)

1-4 (1, 3, 4)

1-5 (2, 4, 5)

2-3 (4, 5, 6)

2-5 (7, 8, 10)

2-6 (8, 9, 13)

3-4 (5, 9, 19)

3-6 (3, 4, 5)

4-6 (4, 8, 10)

4-7 (5, 6, 8)

5-6 (9, 10, 15)

5-7 (4, 6, 8)

6-7 (3, 4, 5)

(b) Solve graphically $\text{Max } z = 0.3x_1 + 0.9x_2$

$$\text{Subject to, } x_1 + x_2 \geq 800$$

$$0.21x_1 - 0.30x_2 \leq 0$$

$$0.03x_1 - 0.01x_2 \geq 0$$

$$x_1, x_2 \geq 0$$

12. (a) Discuss the key ideas for constructing dual from primal.

Or

(b) Formulate the dual of $\text{max } z = 5x_1 + 12x_2 + 4x_3$

$$\text{Subject to, } x_1 + 2x_2 + x_3 \leq 10$$

$$2x_1 - x_2 + 3x_3 = 8$$

$$x_1, x_2, x_3 \geq 0$$

13. (a) Five project are evaluated over a three year planning horizon. The following table gives the expected returns for each project and the associated yearly expenditure.

Project	Expenditure (\$ millions per year)			Returns (\$ million)
	1	2	3	
1	5	1	8	20
2	4	7	10	40

Project	Expenditure (\$ millions per year)			Returns (\$ million)
	1	2	3	
3	3	9	2	20
4	7	4	1	15
5	8	6	10	30
Available fund	25	25	25	

Which project should be selected over 3-year horizon?

Or

- (b) Discuss the recursive nature of dynamic programming computation.

14. (a) Using Newton-Raphson method solve.

$$g(x) = (3x - 2)^2 (2x - 3)^2$$

Or

- (b) Write the Kuhn-Tucker necessary conditions for $f(x) = x_1^4 + x_2^2 + 5x_1x_2x_3$

Subject to

$$x_1^2 - x_2^2 + x_3^3 \leq 10$$

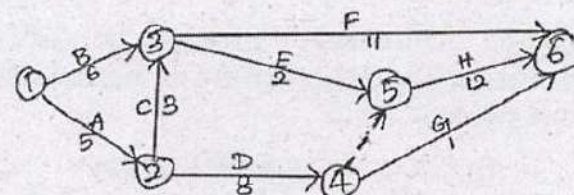
$$x_1^3 + x_2^2 + 4x_3^2 \geq 20$$

15. (a) Draw a network for the following data.

Activity:	A	B	C	D	E	F	G	H	I	J
Predecessor:	—	—	—	—	A, B	E	F	D	G, H	C, I
Duration:	3	2	4	3	2	4	2	1	2	4

Or

- (b) Compute the float for non critical activities of the following network.



SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Solve : Max $Z = 2x_1 + 3x_2$

Subject to $2x_1 + x_2 \leq 4$

$$x_1 + 2x_2 \leq 5$$

$$x_1, x_2 \geq 0$$

17. Solve by dual simplex method min $z = 3x_1 + 2x_2 + x_3$, Subject to $3x_1 + x_2 + x_3 \geq 3$.